GENERAL HEADQUARTERS
FAR EAST COMMAND
MILITARY INVELLIGENCE SECTION, GENERAL STAFF
ALLIED TRANSLATOR AND INTERPRETER SECTION

"Experimentation with Shigella dysenteriae and Shigella
para-dysenteria," by Army Medical College Epidemiology Laboratory,
31 Mar 42.

Doc No 553886

689253



WDGS - INTELLIGENCE REPORT toerimentation with Shigella dysenteriae and Shigella para-dysenteria" 1945 DATE OF INFORMATION: DATE OF REPORT: 31 July 1950 L ORG PREPARED BY: ATTS, G-2 GHO FEC , SOURCE former Japanese Army Forwarded herewith four (4) copies of Allied Translator and Interpreter Section Document Number 553880, dated 11 Feb 50. This is a full translation of "Experimentation with Shigella dysenteriae and Shigella para-dysenteria", a former Japanese Army report by the Army Medical College Epidemiology Laboratory, 31 Mar 42. This report describes experimental procedure and presents conclusions drawn from observations of the cellulicidal time, bacterial count and turbidity in the microscopic studies on the destruction of Shigella dysenteriae and Shigella peradysenteriae suspensions which were treated on the same energy level with supersonic waves at frequencies of 1120, 560 and 280 kc. For the Assistant Chief of Staff, 0-2: J. H. POLK 1 Inclosure Lt Col. GSC 4 copies ATIS Doc. No. 553880 Executive OTE: This document contains information effecting the na-onal defense of the United States within the meaning of the spienage Act, 50 U. S. C.-31 and 32, as amended. Its transtents in any manner to an unauthorized person is prohibited UNCLASSIFIED S FORM 17A mission or the revelation of its con-WDGS -- INTELLIGENCE REPORT UBJECT: Experimentations with Cholera Bacteria ROM: T/T G-2 GHO FFC REFERENCES: DATE OF REPORT: 11 Aug 1950 EVALUATION: DATE OF INFORMATION: 1935-1942 SOURCE: Former Japanese Army Med NCL ONE PREPARED BY: ATIS, G=2, GEQ, FEC SUMMARY OR SID REPORT: Forwarded herewith four (4) copies each of the following Allied Translator and Interpreter Section documents (bound in one cover): Doc No. 55388-A "Supersonic Wave Generator; Experimentation with Cholera," by Army Medical College Epidemiology Laboratory, 31 March 1942. Doc. No. 55388-D "Serological Studies on Supersonic Wave-Treated Polyvalent Cholera Vaccine, " by Army Medical College, Epidemiological Laboratory, 16 June 1942. (full translation) Doc. No. 55388-E "Experimental Research on Toxic Fractions of U.S.W. Cholera Vaccine, " by Epidemiological Laboratory, Army Medical College, 1940 (full translation Doc. No. 55388-F "Research on Cholera Vaccines Treated with Supersonic Waves; Effects of Formalin on Antigenic Properties, " by Epidemiological

NOTE: This document contains information affecting the national defense of the United States within the meaning of the Explorage Act, 50 U.S. C.-31 and 32, as amended, its trans-

UNCLASSIFIED

Laboratory of Army Medical College, 1939 (full translation)

tents in any monner to an unauthorized person to pro-

GHS

U.S. Army PAR EAST COMMAND (MILITARY INTELLIGENCE SECTION, OFFICE STAFF)
ALLIED TRANSLATOR AND INTERPRETAR SECTION

Translation Requested by Theatre Intell, Margets Date Rec'd ASIS 11 Feb 50

Description of Contents: Full translation of "Experimentation with Shigella dysenteriae and Shigella paradysenteriae," by Army Medical College Spidemiology Laboratory, 31 Mar 42.

MANAGE .

U.S. Army PAR EAST CONNERS (HILITARY INTELLIGENCE SECTION, OFFICE SEATE) ALLES TRANSLATOR AND INTERPRETER HECTICS

Translation laquested by Theatre Intella Parista

Smootinging of Contenter Fall translation of "Experimentation with Shigalia dynamics and Shigalia paradysantorine," by Army Medical Gallage Epidemiology Laboratory, 31 Mar 42.

Army Medical College Spidemiological Research Report

Section 2. Number 331

Relationship of Supersonic Mave Frequency and Cellulicidal Action

Part 3. Experimentation with Shigella Dysonteriae and Shigella paradysenteriae.

Army Medical College Epidemiology Laboratory (Maj Gen ISHII, Gommanding) NHDO, Takeshi Mon-official staff

Section 2
Original Copy
Classification
376-33 433-1
Received 31 Nar 42

Table of Contents

General:

- Chapter 1. Outline of experiment.
- Chapter II. Experimental procedure.
 - A. Bacterial strain.
 - B. Basterial suspension.
 - C. Supersonic wave treatment.
 - D. Qualitative tosts on cellulicidal strength.
 - S. Bacterial count.
 - F. Observation of morphological changes.
 - 6. Measurement of turbidity.

Chapter III. Results of experiment.

- A. Cellulicidal time.
- B. Survival test.
- O. Observation of zorphological changes.
- D. Measurement of turbidity.

Chapter IV. Summary and conclusions.

Bibliography

General

In recent times studies on the detoxication of dysentery vaccines have been performed in various quarters. Again, the separation of endotoxins upon destroying the dysentery bacillus cells with supersonic waves has already been reported by several persons. FUNATO has claimed that at a frequency of 560 kc the Shigella dysenteriae can be destroyed in 20 minutes, the Shigella paradysenteriae I in 10 minutes and the Shigella paradysenteriae III in 30 minutes. CEAMI has studied the relationship of cellulicide and turbidity to temperatures.

Revertheless, reports on cellulicide tests employing different frequencies but conducted on the same energy level have not been published as yet. The varying of the destructive effect directly received by the bacterial cell through frequency changes is not believed to be difficult. Following this line of reasoning experiments were performed on the destruction of Shigella dysenteriae and Shigella paradysenteriae at different bacterial concentrations and frequencies.

Chapter I. Outline of experiment.

The treatment of bacterial suspensions as well as the examination of surviving cells, bacterial count, morphology and turbidity was based on procedures outlined in Part 1 (cholera bacteria) of this series. Experiments were performed on Shigella dysenteriae (Suginori strain) and Shigella paradysenteriae (F type).

Chapter II. Experimental procedure.

- As Bacterial strain: The bacteria were from strains kept at this laboratory. These strains indicated uniform turbidity in a bouillon medium and gas was absent in lactose and dextrose vertical media. Milk coagulation was negative. Litums and whey tests were negative. They were negative in lead acetate agar media. Indol reaction was negative for Shigella dysenteriae but positive for the F type. Shigella dysenteriae was negative in the decomposition of carbohydrates such as xylose, rhamnese, sorbit, maltese, arabinose and saccharose. Shigella paradysenteriae was able to decompose maltone and arabinose but not the others. Agglutination titer was 500 times for Shigella dysenteriae (immune nera prepared by Immunological Section) and 1,250 times for Shigella paradysenteriae (prepared by this laboratory).
- 3. Racterial suspension: Bacterial suspensions were prepared in the same manner as that for typhoid bacilli in Part 2 of this peries.
- C. Supersonic wave treatment: As already described in Fart 1, the plate current was regulated to produce a 10° C-per-minute temperature rise in a test tube containing a specific volume of transformer oil for the purpose of maintaining a constant supersonic wave energy level in the test tube at each frequency. The following currents were used to provide the same energy level:

Fraquency	Plate current	Grid current	Plate voltage
1120 ke	460 ma	165 ma	3000 ¥
560 ke	550 ma	130 ma	3300 ¥
280 ke	400 ma	190 ma	3300 ₹

Again following the same procedure as in Part 1 the treatment time at 1120, 560 and 280 kc was 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 50, 60, 75, 90, 105, 120, 135 and 150 minutes.

- D. Qualitative tests on cellulicidal strength: Two platinum loop portions each of the supersonic wave-treated bacterial suspensions were elant-cultured and plate-cultured with agar and bouillon. After incubating at 37° C for 24 hours the results were evaluated as +++ , ++ and -- according to their growth.
- S. Sacterial count: The procedure described in Fart 2 was followed. The supersonic wave-treated bacterial solutions were diluted progressively ten times each with a physiological saline solution. One se of each was mixed thoroughly with agar (45° C) and allowed to solidify. Agar was added again in an amount sufficient to cover the surface. Sacterial counts were taken after incubating at 37° C for 24 hours (48 hours in case of unsatisfactory growth). The counting method has already been described in Fart 1.

As the purpose of this experiment was to determine the number of destroyed bacteria, bacterial counts were taken on the control and also during the intermediate stage and the stage is-mediately prior to destruction. The rate of time decrease compared to the bacterial count of the control was examined.

- F. Observation of morphological changes: Smear specimens were prepared immediately following the superconic wave treatment. Hieroscopic observations were made after the specimens were dried, fixed and single-stained with methylene blue.
- G. Neasurement of turbidity: The bacterial suspensions were diluted with a physiological saline solution according to the ratios shown below and measured with a Pulfrich's photometer. The absolute turbidity was computed from the relative turbidity.

Bacterial solution concentration

Dilution

0.1 mg / 1.0 cc 1.0 mg / 1.0 cc 10.0 mg / 1.0 cc Stock solution 10 times 100 times

Chapter III. Results of experiment. (See Tables 1-6.)

Table 1. Test results on cellulicidal strength; survival and turbidity of Shigella dysenteriae treated with 1120 ke supersonic waves.

Plate voltage 3000 v; plate current 460 ma; grid current 165 ma. Date of experiment 14 Apr 41. Room temperature 29° C.

	CANADA AND AND COME AS PUBLICADOR			0.1 mg					A CONTRACTOR OF THE PARTY OF TH			1.0 mg		******* *******************************			and the latest of		10	.0 mg		
Time (min.	Survive bacteri		Turbidity	Bacterial count -	Survival compared	Log Z	Time (mir	ba	urvival o	of	Turbidity	Bacterial	Survival compared	Log Z	Time (min.)		Survive bacteri	of le	Turbidity	Bacterial count - 16.0 mg	Survival compared	Log Z
	Bouillon	Agar		0.1 mg	to con- trol (%)			Boui	lllon	Agar slant		1.0 mg (Z)	to con- trol			Beu	illon	Agar		(2)	to con- trol (%)	
K	-	afafa	0.015	58.7 x 106		7.7686	H	+	+	+++	0.1037	58.7 x 10 ⁶		8.7686	K	+++	To the Control of Cont	+++	0.8923	5870 x 106		9.7686
1	-		0.012				1	++	A second	+++	0,0981		Million the control of the control o		1	111	and a second	+++	0.8355			
2	-	-+-	0.018	W. W.			1	+	The state of the s	++	0.0788		The state of the s		8	+++	- Income	+++	0.7919			
3	+	-	0.012	0.000158 × 10 ⁶	0.000269	2.1937	- 3	+	4 and a second	++-	0,0691	13.5 x 10 ⁶	5.3862	7.4988	8	++	Compression of the compression o	++	0.6131			
4		Splanner	0.012	re-manufacture of the control of the			4	-	- The second		0,0680				4	++	output of the state of the stat	++-	0.5577		*	
5	-	*******	0.011				16	+	and the second s	+	0.0680	3.66 x 10 ⁶	0,6064	6.5514	5	++	and a second	++-	0.5353			
6	10000000	Acumumenterior	0.012				6	+	+	++-	0,0663		the second secon		6	++		++	0.5242			
7		-	0,010				. 7	-		1.40gChiebs	0,0725		The second secon		7	++		++	0.4284			
8	entrampane.	-Managemen	0.012	Manuscript Control of the Control of			8	-	- Andrews	********	0.0791		Section Communication of the C		8	tt		++-	0,4907			
9	-	NOT THE REAL PROPERTY.	0.014				9	-		CHARGO, CO.	0,0803		territoria del constitución de la constitución de l		9	++	non Services	++-	0.5019			
10		CHARLES	0,014				10			Montenance	0,0981				10	++	-	++	0.5186			
15	attended and	anappera.	0.014				1,5	-	Marke State	Will Section 2	0.1138				20	+	and the second	-	0.5298	212.6 × 10 ⁶	0.3611	8.3275
			The same of the sa				100	-		OPPRINTED IN	0,1360				40	+		+	0,6134	7.69 x 10 ⁶	0.1310	6.8859
			A Commission of the Commission				30				0.1860		The second secon		50	+	and the state of t	-	0.5855	0.45 x 10 ⁶	0.000076	5.6532
			and the second s					and the second s							60	and a second	-	ecoloteses.	0.9644			
								Printer and Captures							75	-		-	0.8750		The state of the s	

Table 2. Test results on cellulicidal strength; survival and turbidity of thigella dysenteriae treated with 560 ke supersonic waves.

Plate voltage 3000 v; plate current 550 ma; grid current 130 ma. Date of experiment 11 Jun 41. Room temperature 26° C.

				0.1 mg	ericanah-conservata bar kanaga cakaka cakabahan kalabahan kanaga cakabahan kanaga cakabahan kanaga cakabahan k	and an account of the first of	AND COLOR OF THE PROPERTY OF T		1	.O mg						10.0	mg		*	
Time (min.)	Survival bacteria		Turbidity	Bacterial	Survival compared to con-	Log Z	Time (min.)	Surviva bacteri		Turbidity	Bacterial	Survival compared	Log Z	Time' (min.)	Surviva bacteri		Turbidity	Bacterial	Survival compared	Log Z
	Bouillon	Agar		0.1 mg (Z)	trol (%)			Bouillon	Agar		1.0 mg (Z)	to con- trol (%)			Bouillon	Agar		10.0 mg (Z)	to con- trol	
K	++	1	0.00714	54.91 x 10 ⁶	3	7.7775	R.	+++	+++	0.08081	599.1 x 10 ⁸		8,7776	x	+++	+++	0.82540	\$991.650 × 10	56	9.775
1	++	++	0.01528	Service and the service and th			1	+++	+++	0.07808				1	+++	+++	0.62462			
2	++	++	0.01717				2	+++	+++	0.07478	*			2	+++	+++	0.58000			
8	++	++	0.01168	0.259 x 10 ⁶	0.432	5.4133	8	+++	+++	0.06246	8.145 x 10 ⁶	1.525	6,9108	3	+++	+++	0.63578			
4	++	++	0.01258		*	are constituted as a second	4	+++	+++	0.05967			Commence of the Commence of th	4	+++	+++	0.63020			
5	+	+	0.01199	0.031 x 106	0.052	4.4771	5	+++	+++	0.06157	2.820 x 10 ⁶	0.470	3.4502	5	+++	+++	0.586886			
6	+	-	0.01127				6	-++	1++1	0.06581				6	+++	+++	0.63578			
7	+	+	0.01048				7	+++	+++	0.06912				7		1+++	0.53539			
8	-	-	0.01026				8	++	1++	0.06577	1.968 x 10 ⁶	0.829	6,2941	8	++	++	0.55770			
9	-	-	0.01004				9	++	++	0.06465			A secretarion	9	++	-++	0.51308	-		
10	manus.	-	0.00988		The Control of the Co		10	+	+	0.06967	0.119 × 10 ⁶	0.020	5.0755	10	++	1++	0.52424			
1.6	-		0.00948		Programme or season and the season a		15	+	+	0.09346	0.108 x 10 ⁶	0.019	5.0334	20	+	+	0.41828	4.750 x 10 ⁶	0.071	6.6772
20	***************************************	-	0.00988		To Annual Property of the Prop	diameter and the second	20	+	+	0.07696	0.099 x 10 ⁶	0.016	4.9956	30	+	+	0.48520	1.976 x 106	0.003	6,2958
80	-		0.01312				30	+	+	0,08087	0.070 x 106	0.013	4.8461	40	+	+	0,50193	0.905 x 106	0.0015	5.9566
40		-	0.91239				40	+	+	0.08142	0.007 x 10 ⁶	0.002	3.8451	50	+	+	0.45731	0.667 x 10 ⁶	0.009	5.8241
1							50	-	-	0.07585			description of the second of t	60	+	+	0.42943	0.669 x 108	0.009	5.8814
							60	-	-	0.09927				76	+	+	0.50183	0.306 x 106	0.006	5.4857
1							76	-	+	0.1039		The second secon		90	+	+	0.41270			
						National Control of Co	1					The second state of the second		105	+	+	0.51867	0.297 x 106	0.004	5.4728
												ed-distribution of the control of th	the contract of the contract o	120	+	+	0.53540	0.226 x 10 ⁶	0.003	5.3541
	desertation of the residence of the resi					Security of Contract of Contra						and the control of th	of experiments	235	+	+	0.55213	0.0186 x 10 ⁶	0.00005	4.2696
					*							age track mission or an artist of the state		150			0.66586			

Table 5. Test results on cellulicidal struncth; survival and turbidity of Thirella dysanteriae treated with 280 he supersonic waves.

Plate voltage 3500 vs plate current 400 mas grid current 190 mm. Date of experiment 1° Jul 41. Som temperature 25°C.

-				0.1 mg								1.0 mg					,	3.0	1.0 mg		
(mim.)	Surviv		Turbidity	Pasterial count - 0,1 mg (E)	Survivel compared to con-	Log Z	,	e n,)	Survival	l.	Turbidity	Tactorial	Survival	Log 2	Time (win.)	Purvivi baoter	in	Purish the	Bacterial court - 10.0 mg	Compared to com-	Log E
	Povillen	Agar		(8)	trol		A Commission on the		Penilles	Arar		(8)	trol			Manufillan for 1 % and	alemit		(2)	(i)	
E		+++	0.00070	57.670 x 10 ⁶		7,7009		Z		+++	0.08073	576,790 x 10 ⁸		8,7600	20		+-+-	0. 78055	5767.200 x 10 ⁶		9.7609
1	+++	+++	9,00981	15,666 x 10 ⁶	25,128	7,1361		1	1+++	+++	0,05848				à			0,57443			
2	111	+++	0,00878		9			2	1+++1	++++	0,04974				8			0.53039			
8	+++	+++		2.715 × 106	4,708	6.4338		8		+++	0,06400	47,436 × 10 ⁶	A5.803	8. 728	8	+-+-		0,49077			
4	+++	+++	9,00000		200			4		+++	0.04968				4			0,46280			
5	+++	+++		0.076 z 10 ⁶	9,139	4,8976		5	+	+++	0,06886						+++	0.43425			
6	++	++	0,00688					85 49	++	++	0,05551					Comment Description Code According to the Code Code		0,47962			
8	++	++		0.004 z 10 ⁶	0,007	8,6022		a	The second secon	++	0,06124	2.103 x 106	0,386	6, 3229				0.61342			
9		_	0.00962		39.00			S	+	+	0.06136				9	+++	+++	0.59116			
20	**********		0.00708	The districtive and the second				<u>In</u>	+	-	0.05987	1.020 × 10 ⁰	0.294	6,2116	30	++	+++	0.49655			
			The Control of the Co					16	+	+	0,04796	0,820 x 10 ⁶	0.001	5,7100	25	++	+++	0,39697	Sel. 212 x 10 ⁶	0.627	P. 6586
								RO	-	collips	0,05577		NECESTRATION TO A SECURITION OF THE SECURITION O		20	+	++	0.00017	0.972 ± 10 ³	0.0171	5.9877
		e delication of the second of		to et al-				25		-	0.06698					-	-	0.37723			
			the control of the co	the statement of the st					and the second						90	-	- Childrenger	0.61271			
		all public and a control of the cont	and grant of a state of the sta	and the second second					DE CALANTA CALANTA		- Contraction				40	-	egregoe.	0.33808		derive all regions and the second sec	
		and the second s					assistance relativists to an	April Advantage standard standard or An	And the state of t	and the state of t			A CONTRACTOR OF THE PRODUCTION	the special serve seems transferment, 1740 ; \$100,000	The state of the s			The state of the s			

Table 4. Test results on colludicidal strengths survival and turbidity of Di ella paradysemberiae treated with 1120 he experience.

Plate voltage 5000 vs plate current 400 mas grid current 165 ma. Date of experiment 16 Apr 41. Boom hemorature 200 C.

				0.1 mg							1.0 mg							10,0 mg		
Time (min.)	Survival basteris		Turbidity	Count -	orrival	Log Z	Timo Lein.)	lumiva bacterii	l of	Surbidity	"asterial	Survival commered	Log I	Pine (min.)	Survive		Turbility	Pactorial	Lavival	Log Z
	Bouillon	Ager		3.1 mg	trol		ar ter tilligg av skar skur sp., tre skap språvelad konstituen havet	Coullian	Acer slamt	Application of the control of the co	1.0 mc (z)	to one-	Barren () spin and description of subjects about		Povillon	Acor		10 mg	to con- trol	
1 2 3 4 5 6 7 6 9 10	++++++	++++++	0.01098 0.01360 0.01086 0.00986 0.00986 0.00986 0.00988 0.01098	50.88 x 10 ⁶	0.0200	7.4847	1 2 3 4 5 6 7 8 9	+++++++++++++++++++++++++++++++++++++++	+ + + + + + + + + + + + + + + + + + + +	0.00569 0.00266 0.00266 0.007604 0.06692 0.06500 0.06692 0.06697 0.06184 0.06877 0.06184	26.6 v 10 ⁶	2.000	7.4889 6.9455 9.9261		+++++++++++++++++++++++++++++++++++++++	+++++++++++++++++++++++++++++++++++++++	1.101 0.881 0.881 0.788 0.788 0.788 0.688 0.688 0.788	277 x 10 ⁶ 277 x 10 ⁶ 207 x 10 ³	90.0873 67.0000	9.4847 9.4847 9.4425 9.3160 4.1761
				Market var describes man manure statutes describes manures en (Alberto)								Carlos de Carlos		\$0 60	+	+	0.702	0.0058 x 106	0.0018	5,7084

Table 5. Test results on collulisidal strength; survival and turbidity of the cile paradomenteries trust of with 550 kg supersonis waves.

Flate veltage 5000 vs plate current 550 mas grid oursent 150 ma. Date of experiment 8 to 41. Form temperature 2500.

Purbletty Rentertal command to ame and to ame to am		12 A a a a a a a a a a a a a a a a a a a	- 0,00238 - 0,02580 - 0,01424 - 0,77198 - 0,72503 - 0,84770 - 0,68678 - 0,70270 - 0,59116	factorial sensit = 10.7 mg (E) 2896,300 x 10 ⁶	Servivel compared to the treal	9,558
0.07196			1.08788 - 0.90238 - 0.90238 - 0.91626 - 0.71626 - 0.72501 - 0.68578 - 0.70270 - 0.59116		(5)	
0,00000 0,00000 0,00000 0,00000 0,00000 0,00000			1.08788 - 0.90238 - 0.90238 - 0.91626 - 0.71626 - 0.72501 - 0.68578 - 0.70270 - 0.59116	2896,300 x 20 ⁶		
0.07529 0.07027 0.06006 0.07027 0.07027 0.07027 0.07027 0.06000 0.06000			0,00500 0,01426 0,77103 0,78503 0,84770 0,65078 0,70270 0,59116			
0.07027 0.06804 0.07027 0.07027 0.07027 0.07027 0.06800 0.06800			- 0,01686 - 0,77198 - 0,78501 - 0,84770 - 0,65578 - 0,70270 - 0,59116			
0.06866 0.07087 0.07087 0.07087 0.07087 0.06860 0.06860			0.77188 0.78501 0.84770 0.68678 0.70270			
0.07087 0.07087 0.07087 0.07087 0.0660	9	+++++++++++++++++++++++++++++++++++++++	0,78501 0,84770 0,68678 0,70270 0,59116			
0.07087 0.07087 0.07087 0.06680 0.06680	9		0,84770 0,68678 0,70270 0,59116			
0.07280 0.07087 SSO.COX x 10 ⁶ 94.900 0.06680 0.06680	9.8468 8 -	+++ +++	0,70270			
0.07087 SSO.60X × 10 ⁸ 94.900 0.06480 0.06482	8.8488 8 -	+++++	0,70270			
0,0000	30 -	++++	0,89116			
0,0000	20 -					
	10 -					1
		++++	0,00098			
0.05577 500.887 x 10 ⁶ 86.100	8,4931 30 -	+++ ++	0,44516			
0,00088		+++++			-	
0.05968 899.958 x 10 90.027	8.4778 40 -	+++ ++	0.87387	388,186 w 106	0,007	8,5508
0.04964 452.5 x 10 ⁶ 1.259	6.0886 85 -	+++ ++	0,22008	122,690 × 106	0.869	n.ones
0,06486	60	+++ ++	0.8038	41,424 m 108	0,111	7,6362
0.00000	75		0,10791	7,034 x 108	0,780	0,0600
0,03023	20	+ -	0,13943	0.300 m 106	0,002	8,8000
0.10262	108	+ +	0,11156	0.808 × 106	0,0000	6,4024
	180			0.307 × 108	1,0018	8,0908
	356	+ -	0,18059	0.000 × 10 ⁸	0.0001	4,0306
	150	MODEL IN COLUMN	- 0.12200	end of the contract of		
	0.06485	0.06488 60 75 75 75 76 76 76 76 76 76 76 76 76 76 76 76 76	0.06465 0.063666 0.063666 0.063666 0.063666 0.063666 0.0636666 0.0636666 0.06366666 0.063666666666 0.0636666666666	0.05485 0.05200 0.053000 0.053000 0.05300 0.05300 0.05300 0.05300 0.05300 0.05300 0.05300 0.05	0.05405 0.055000 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.055000 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05500 0.05	0,05405 50

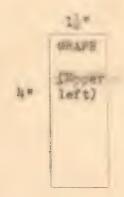
Table 6. Test results on cellulicidal strength; survivel and turbidity of Pricella paradysenterias treated with 280 hs supersonic waves.

Plate reliance 3800 vs plate current 400 mas grid current 190 ma. Fate of experiment 2 Jul 41. Room temperature 1200.

				0.1 ag							1.0 mg						1	10.0 mg		
Time (min.)	Surviva bacteri		Turbidity	Pasterial count -	Survival economed	Log 2	" me	Same		Turbidity	Destorial	Suprival compared	leg f	Tina (min.)	. Carrina Transfers		Turbidity	amerial	Supering?	Log Z
7.00 Q. 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	Rouillan	Agar		20 (2)	to come trol			Forillan	Aray slamb		1.0 mg (E)	to non- tral (d)			evillon	Aray		27. (27	trol (1)	
R	-+-		0,00959	80,652 = 103		7.4964	X		916	0.00700	306.580 H 10 ⁸		2.4884	N.			o"ha ,ing	Zuer's X Jug		0.4804
1	The second secon	. C.	0,02348	1			1	444		0.63681		Section 1	And the second s	1	= bh		0. 1434			
8			0.01010				2	+41-	###	0.05911	CRISTON PROCESSOR AND PROCESSO			2	744		J. 15213		d c	
\$	e and an animal animal and animal animal animal and animal	The second secon	0,00781				8	1/91-		0.05577		9		8	45	A	0.62468			
4	E approximation of the property of the propert	T	0,00583	*			% 4			0.05364		- 1		4	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	e de la companya de l	0.50103	<i>4</i>		
5		And the second s	0,00746				8	- 41	4	0.04796	8,610 x 106	1,100	0.6580	5	111		0.51270			
6		E control on the control of the cont	0,00705				6			0.04517				6	110	Total Control of the	0.33462		:	
7	e allevade solete en verse)	de lan care la de	0.00519				7			0.04461					111	The property of the second of	0,3512			
	of interest livering the state of	Application of the state of the	0,00714				8	441		0.04575	1.696 * 108	0.665	8,2205	9	Dil	Service County of Services	0.50118		:	
10		W. Valla procedure der	0.00708				10	7971	3115	0,04052	2 200 - 206	- 070		10	111	The state of the s	0.84577			
15		Per Property Broades - New York	0.00024				15	-		0,04461	1.585 x 106	n _e 816	8,1498	10	140		0.24559	21.202 × 100	6.004	7 52 0000
							20			0.06577	100 mm 1 2 mm	1000000		30		To describe the second	0.94702	2,409 = 106	0,694	7,3276
:	diameter of the second street, and the second		god accommong to	***			25	-		0,04463				25		See all the second seco	0.19854	0.000 x 10 ³	0,329	8,3959 5,9566
		California of the second	The state of the s	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			30	-	_	0.03513		-	To the state of th	30		To ANNA THE TAXABLE PROPERTY.	0,18908	Accounts		
	Children matter control and an address of the control and		No. Common or July Delivering								The second secon	1		40	- 1		0.17548	the same of the sa	the street of th	
	and the state of t	And and the second seco	Navago e e e e e e e e e e e e e e e e e e e											80	-	To change the strategy and stra	0.10781		-	The state of the s
	entry to entry trees.	and the same of th	To a series of the series of t		Total Control of Contr						The second secon			60		decomplete and restrates	0.17269	And the second of the second o	•	
and the second		a palitiment of the state of	State of the state											printed to the second the second second second	· A SANTANIAN STANIA					

The survival times of bacteri; are listed in Figures 1 to 5; mornhological changes are shown in Pables 7 and 8.

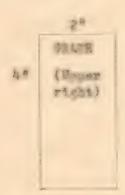
Figure 1. Pasterial count variations of G.1 mg/ 1.0 oc tasterial (Chigella dysenteriae) solution



Lex

- (1) Bacterial count.
- (2) (Stock colution).
- (3) Time (minutes).

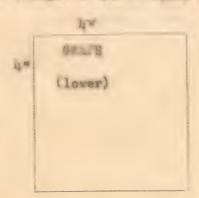
Figure F. -actorial count variations of 1.0 mg/



197

- (1) Bacterial sount.
- (2) Time (minutes).

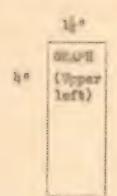
Figure 1. Actorial count variations of 10.0 mg/



Her

- (1) Excterial count.
- (2) (Stock solution).
- (3) Time (minutes).

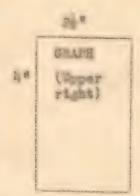
Figure 4. Eactorial count variations of 0.1 mg/



KAY

- (1) Agotorial count.
- (2) (Stock solution).
- (3) Fine (Minutes).

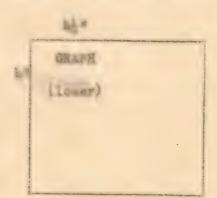
Figure 5. Sactorial count variations of 1.0 mg/ 1.0 co basterial (Bigella paradysenteriae) solution



Ker

- (1) Basterial count.
- (2) Time (minutes).

Figure 5. Pacterial count variations of 15.0 mg/



Ker

- (1) Bacterial sount.
- (2) (Stock solution).
- (3) Time (minutes).

he	6-1	9009	South,	P-A	timp.
200.00	ALM W	70 04 77	2027	LA SEL	(1) A. (1) (1) (1) (1)

	l e-mcentration	0.1 ms	1.0	10.0 ng
Exctorial type		, en waren o ter fr		
Chigolla dysenterize	1120 550 250	3 8	7 50 20	60 150 25
Shizella paradysenteriae	100 550 20	8 40 7	20 65 20	75 150 30

At the same surerectic wave energy level the cellulicidal time for both bacterial types is appelerated at higher dilutions and lover frequencies. (At 1170 kg acceleration was noted in the O.1 mg and 1.0 mg accentrations.)

The values obtained for the Unigella dysenteriae at 1170 kg are three minutes for 1.1 mg and seven minutes for 1.2 mg. At 260 kg cellulicide occurs to 21 winutes for the 1.0 mg concentration. Destruction of Unicella gradysenteriae at 250 kg occurs in seven minutes for o.1 ms. 70 minutes for 1.0 mg and 30 minutes for 10.0 mg. Selluticidal strength is the highest at 1170 kg followed by 260 kg; this action is returned at 500 kg. as cases arise where this strength is inversely proportionate to the wave length, some amount of flustuation is produced.

B. Survival test: (see figures 1 to 5.) The graphs show a logarithmic decrease of bacterial count after a supersonic wave treatment. By taking the b sterial counts in the graphs as logarithmic scales (vertical axes) and the treatment times as arithmetical scales (norisontal axes), approximately straight lines are formed. A step-like decrease is indicated by the 10.0 mg concentration. By treating the bacterial count as y and the treatment time as x, the relationship

les y = 2, or y = 1-30 (C = negative constant)

is obtained.

Though not distinct in Figures 1, 2, and 5, a sharp reduction in live testerium count can be seen by stating the bacterial counts for the 10.0 mill. Co concentration shown in Figures 3 and 5. At the same energy level this reduction becomes pronounced as the frequency decreases or, in other words, as the wave length increases.

The time required for the lag of the live bacterium count of the 10.0 mg/1.0 cc concentration to become halved is shown below.

Wignite 1	1190 kg 560 kg 200 kg	s, resientely	60 min. 40 min. 20 min.
abirella paradysenteriae	1190 ke 500 ke	Approximately	b5 win.

C. Deservation of morphological changes: A condensation of the results from Tables 7 and 8 is presented below.

Prequency (kg)	ency	(ke)		2	Annual Medical Control of the Contro		360			280	
Bur .	and Sil	Bacterial vel. it (mg)	F .	3.0	0.	· ·	0.7	0.01	E . C	5,0	0.0
The state of the second		(cellulicidal time) Inatilli, to strint Celluli, strintina Celluli, strintina Responsition of grander Cestruy a cellular atter Closey	M 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	w 11161 116	8 2-545 88-		8 84548 384	W carda Bau			8 RUHUMU POZH
Shighling sectorise	H AMING A	institution time) [Estitution to stain [Situation telementing [Situation telementing [Situation telementing [Situation telements [Situation telementing [Situation tele	E 20102 110	5 0 mmm 1 13	8 00 20 20 20 20	2 1-111 125	2 20101 802	2 wrows 220	O WILLI NEL	2 1 4 - N N N 1 K	K OMMET HOW

D. Leasurement of turbility: As shown in Tables 1 to 6, transparency was not observed among suspensions of unicella dysenteriae and unicella paradysenteriae within the supersumic wave frequency rance covered by this experiment. A change was detected only in the 15.0 mg concentration of thicella paradysenteriae but changes in the others seemed to be non-existent.

Chapter IV. Danuary and conclusions.

The following conclusions ere reached after observing the cellulicidal time, eactorial count and turbidity and after making misroscric studies on the destruction of Shigella dyseaterine and Lifella paradysenterine suscensions which were treated on the same energy level with supersonic waves at frequencies of 1173, 967 and 260 kc.

- i. It the same supersonic wave energy level the cellulicidal time for concentrations up to and including 1.0 mg is accelerated at 1170, 260 and 500 kg, in that order. The time for 10.0 mg is accelerated only at 260 kg. Consequently, the time at which cellulicide occurs is directly proportionate to the frequency and somewhat inversely proportionate to the wave length. A slightly greater amount of difficulty is experienced in the destruction of Chigella paradysenteriae compared to Shigella dysenteriae.
- F. The cellulicidal time decreases as the Sactorial concentra-
- E. The changes produced in live bacteria, when based on treatment time, can be expressed logarithmically and cossess roughly the following relationship:

log y = ax

(c = megative constant).

- destruction occurries at 500 kg, 1100 kg and 500 kg, in that order.
- II. France, ready a sea not result then hirells dysecterize and thirells or contents a situated the a significant saline solution are treated with an eracuic waves. A slight change can be noticed in the case of the 1... and 1.0 or concentration but changes in the others are practically unabserved.
- F, dellular destruction can not be gauged by changes in turbidity.

Biblingraphy

- 1. France, Jun, Lestructive Action on Sactoria with Impersonic raves, Second Scort a scients with Sacillus coli, Sacillus typhi, Sacillus caratyphi and Sacillus dysenteriae, Slate Bl. H. J. U. St. J. Gald Lineau (Japan Journal of Sicrobiology and Sathology), Vol. 32, Ac. 5. June 1958.
- 2. CLANI, Shigehi, Pelation between Internal Convertures and Cellulicidal Action, Furbidity Changes and Followetric Change of Sectuations rested ith Uncremic aves, ATEM SIGILLY OF THE ZASSEL, Vol. 32, No. 10, October 1938.

- 3. *Laci, hireki, Velunetric and Furbiffty Thenree Occurring in Sectorial eletions regard over Extensive eriods with Occurring rayes, 100 Single of the U.S. Vol. 37, No. 13, Detaber 1935.
- t. Mith C. Siro. Frents of upersonic waves on Antibodies (second second) a eximentation with Complement Fixution substances. Six W Million V 2. 1 ALV AASSEL, Vol. 33, No.3, Narch 1939.
- 5. M. L. Liye, freets of vermils aves m intidadies (him somet) verimentation with Freeightin, MIN m st distribution in IGARU BASSMI, Vol. 33, No. 5, Nay 1939.

frequencies.

Property Company Com												100/00/00	60 to				And a second of the second of	1	and the second of the second o	Constructive best form. And energy				the state of the s							
	Microsoc	opio		Cellular swelling	logical deforma-	destruc-	(homogen-			Dust- like	Normal	Inability to stain	Cellular swelling	logical defor-	destrue-	plasm (home;	2011- 202)		Cloudy	Dost- like	Normal		Cellular swelling	defor-	destruc-	plasm (homogen-		Cloudy		1	Inability to stain
### ### ### ### ### ### ### ### ### ##		TI	133													PROPERTY OF THE PROPERTY OF T			and the second s				Trings have a constitution of the constitution								
## ## ## ## ## ## ## ## ## ## ## ## ##			¥ 1 2 3 4 5 6 7 8 9 10 15 20			++++++				+++++	++		+ + + + + + + + + + + + + + + + + + + +							+++++++++++++++++++++++++++++++++++++++	++++++		++++	++-	+++++++++++++++++++++++++++++++++++++++	+++			+++++++++++++++++++++++++++++++++++++++	+++++	+
## ## ## ## ## ## ## ## ## ## ## ## ##	uo		X 1 2 8 4 5							-	# # # + + + + + + + + + + + + + + + + +		++++		++++					++++	## ## ## ## ## ## ## ## ## ## ## ## ##		+	-	++				+++	#######################################	
1 1	Recterial solution concentrat		76		ACTION CONTRACTOR OF THE PARTY	++-++-++-++-++-++-++-++-++-++-++-++-++-		++		1 +			+++++++++++++++++++++++++++++++++++++++		+++++++++++++++++++++++++++++++++++++++					+++++++++++++++++++++++++++++++++++++++	++++++			+	+++++		++-		+++++	+++++	
10.0 40 # # # # # # # # #	10.0 mg	10 12 12 12	50 60 75 90 105 120							++++++++	+ + + + + + + + + + + + + + + + + + + +	1	+++++++++++++++++++++++++++++++++++++++							+++++++++++++++++++++++++++++++++++++++	#########		+++++++++++++++++++++++++++++++++++++++	++++	+++++++++++++++++++++++++++++++++++++++	++			+++++++++++++++++++++++++++++++++++++++	# # # # + + + + + + + + + + + + + + + +	

Table U. Mercacopio observations on morphological changes in Shigolia paradysenterias at various supersonic wave for supersone.

	vency	made the means of the	1120 kg											and the second second		560 kg		PARISHMAN		200, be									
Meroscopie observations		Sellule	lorpho- logical deforms	Cellular destruc-	reto- plant (homogen- teation)	Gracular	A CONTRACTOR OF THE PARTY OF TH	Dust- like	Earnal	Inability to stain	ampliing	Norpho- logical deforma- tion	Cellular Sontruc-	Proto- place (herio: per- implication	Femiler		Dest-		inability to stein	Collular swlling	Corpho- logical defensa- tion	Cellular destruc- tion	Proto- plass (Homogor- isotion)		lody	Dust- like	Serest	nebility to stain	
		Time Time Time Time Time Time Time Time				+++			11++++++	# # # + + + + +				1++++++++++++++++++++++++++++++++++++++					# # # + + + + + + + + + + + + + + + + +							++++++			
ial solution concentration	L.C	T 1 2 3 4 5 7 8 9 10 15 20 30 40 60 60			1 #					+++++++++++++++++++++++++++++++++++++++		+++++++++++++++++++++++++++++++++++++++		1			111111111111111111111111111111111111111	1	+ + + + + + + + + + + + + + + + + + + +	++++++	1	+++		+++	+++		+++++	+++++++	
19359	0.0	75 90 11 2 3 4 5 6 7 8 9 10 15 20 25 30 40 50 60 75 90 185 180 185 180 180 180 180 180 180 180 180 180 180				++				+++++++++++++++++++++++++++++++++++++++			++++	= + + + + + + + + + + + + + + + + + + +		+++++++++++++++++	+ + + + + + + + + + + + ‡ ‡ ‡ ‡ ‡ ‡ ‡ ‡	+	+++++++++++++++++			+++	1 + + + + + + + + + + + + + + + + + + +			++++++++++	++++++++++		

